IN THE CLAIMS:

The following listing of claims will replace all prior versions and listings

of the claims in the above-identified application:

Claim 1 (Currently amended): An apparatus for variable bit rate video

coding of video data on the basis of a ~~predetermined~~ target average bit rate comprising:

a video coding means for coding input video with a predetermined

quantization step size and providing coded data and a generated code bit count;

a quantization step size setting means for <u>calculating average complexity</u>

<u>of whole coded data from the quantization step size provided to the video coding means</u>

<u>and also the generated code bit count provided from the video coding means and for</u>

setting a reference quantization step size for each first image unit, corresponding to ~~an~~

~~average bit rate, from the predetermined~~ <u>the target</u> average bit rate <u>from the average</u>

<u>complexity,</u> ~~the quantization step size provided to the video coding means and also the~~

~~generated bit count~~; and

a quantization step size adjusting means for calculating <u>a bit balance of</u> the

~~average bit rate from the~~ generated bit count <u>with respect to the target average bit rate</u>

<u>with a virtual buffer that is independent of picture types</u> and for adjusting the <u>reference</u>

quantization step size provided from the quantization step size setting means for each

second image unit ~~from the generated bit count provided from the video coding means~~

~~and also~~ from a <u>the</u> bit balance ~~of the generated bit count with respect to the~~ to the

~~average bit rate.~~

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Claim 2 (Original): The apparatus for variable bit rate video coding according to claim 1, wherein:

the first image unit is a group of a plurality of picture frames.

Claim 3 (Original): The apparatus for variable bit rate video coding according to claim 1, wherein:

the second image unit is a group of a plurality of macro-blocks as divisions of one picture frame.

Claim 4 (Original): The apparatus for variable bit rate video coding according to claim 1, wherein:

the quantization step size setting means for setting the reference quantization step size for each first image unit computes an image unit complexity defined by the product of the average quantization step size over the preceding coded image and generated bit count, and also computes the reference quantization step size for each first image unit from the ratio between the first image unit complexity and the average bit rate.

Claim 5 (Original): The apparatus for variable bit rate video coding according to claim 1, wherein:

the quantization step size adjusting means for adjusting the quantization step size for each second image unit sets a minimum permissible quantization step size

Claim 6 (Original): The apparatus for variable bit rate video coding according to claim 1, wherein:

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the quantization step size adjusting means for adjusting the quantization

step size for each second image unit sets a maximum excess of the average bit rate, sets a

virtual buffer sized to the maximum excess from which codes are withdrawn at the

average bit rate and adjusts the quantization step size for each second image unit by using

the buffer occupancy in the virtual buffer and a utilizable buffer size obtained by

subtracting the buffer occupancy in the virtual buffer from the size thereof.

Claim 7 (Currently amended): The apparatus for variable bit rate video

coding according to claim 1, wherein:

the quantization step size ~~setting~~ adjusting means for ~~setting the reference~~

adjusting the quantization step size for each second image unit includes a means for

computing a first quantization step size by adjusting the quantization step size for each

second image unit from the generated bit count provided from the video coding means

and the bit balance to the average bit rate; and

it sets a maximum bit rate, computes a second quantization step size,

which is set in the case of constant bit rate control on the basis of the maximum bit rate,

from the quantization step size set in the quantization step size setting means and the

generated bit count provided from the video coding means, and provides the greater one

of the first and second quantization step sizes to the video coding means.

Claim 8 (Original): The apparatus for variable bit rate video coding

according to claim 1, wherein:

the quantization step size setting means for setting the reference

quantization step size for each first image unit computes a first image unit complexity for

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each first image unit, the first image unit complexity being defined by the product of the summation of generated bit count and the average quantization step size for each first image unit, and determines the quantization step size of the first image unit from the first image unit complexity of the first image unit and the bit count per first image unit.

Claim 9 (Currently amended): The apparatus for variable bit rate video coding according to claim 1, wherein:

the quantization step size setting means for setting the reference quantization step size for each first image unit computes the first image unit complexity for each first image unit from the summation of the generated bit count and the average quantization step size for each first image unit, and determines the quantization step size of the first image unit from the average first image unit complexity for the first image unit over the preceding coded image, the ~~average~~ first image unit complexity of the immediately preceding first image unit or <u>an average of</u> a plurality of <u>the</u> first image unit <u>complexity</u> including the immediately preceding first image unit and the bit rate per first image unit.

Claim 10 (Previously amended): The apparatus for variable bit rate video coding according to claim 1, wherein:

the quantization step size adjusting means for adjusting the quantization step size for each second image unit preliminarily sets a threshold for quantization step size,

when the bit balance of the generated bit count with respect to the average bit rate is not excessive, the reference quantization step size set for each first image unit is

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compared with the threshold for quantization step size, for

providing the quantization step size without any adjustment when the reference quantization step size is not exceeding the threshold quantization step size, and

adjusting the quantization step size according to the bit balance to the average bit rate and selectively providing the greater one of the adjusted quantization step size and the threshold for quantization step size, and

when the bit balance of the generated bit count with respect to the average bit rate is excessive, the quantization step size is adjusted according to the bit balance to the average bit rate, the adjusted quantization step size being provided as the quantization step size for each second image unit.

Claim 11 (Currently amended): A method of variable bit rate video coding of video data on the basis of a ~~predetermined~~ target average bit rate comprising:

a video coding step of coding input video with a predetermined quantization step size and providing coded data and a generated code bit count;

a quantization step size setting step of <u>calculating average complexity of whole coded data from the quantization step size provided to the video coding step and also the generated bit count provided from the video coding step and of</u> setting a reference quantization step size for each first image unit, corresponding to ~~an average bit rate, from the predetermined~~ <u>the target</u> average bit rate <u>from the average complexity,</u> ~~the quantization step size provided to the video coding step and also the generated code bit count provided therefrom;~~ and

a quantization step size adjusting step of calculating <u>a bit balance of</u> ~~the~~

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average bit rate from the generated bit count <u>with respect to the target average bit rate</u>

<u>with a virtual buffer that is independent of picture types</u> and of adjusting the <u>reference</u>

quantization step size provided from the quantization step size setting step for each

second image unit ~~from the generated code bit count provided from the video coding step~~

~~and also~~ from a <u>the</u> bit balance ~~of the generated bit count with respect to the average bit~~

~~rate~~.

Claim 12 (Original): The method of variable bit rate coding video data

according to claim 11, wherein:

the first image unit is a group of a plurality of picture frames.

Claim 13 (Original): The method of variable bit rate coding video data

according to claim 11, wherein:

the second image is a group of a plurality of macro-blocks as divisions of

one picture frame.

Claim 14 (Original): The method of variable bit rate coding video data

according to claim 11, wherein:

in the quantization step size setting step of setting the reference

quantization step size for each first image unit, a first image unit complexity is computed,

which is defined by the product of the average quantization step size and generated code

bit rate over the preceding coded image, and also the reference quantization step size for

each first image unit is computed from the ratio between the first image unit complexity

and the average bit rate.

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Claim 15 (Original): The method of variable bit rate coding video data according to claim 11, wherein:

in the quantization step size adjusting step of adjusting the quantization step size for each second image unit, a minimum permissible quantization step size is set.

Claim 16 (Original): The method of variable bit state coding video data according to claim 11, wherein:

in the quantization step size adjusting step of adjusting the quantization step size for each second image unit, a maximum excess of the average bit rate is set, a virtual buffer sized to the maximum excess is set for withdrawing codes at the average code bit, and the quantization step size is adjusted for each second image unit by using the occupation content in the virtual buffer and a utilizable code bit count obtained by subtracting the occupation content in the virtual buffer from the size thereof.

Claim 17 (Currently amended): The method of variable bit rate video coding according to claims 11, wherein:

the quantization step size ~~setting~~ <u>adjusting</u> step of ~~setting the reference~~ <u>adjusting the</u> quantization step size for each second image unit includes a step of computing a first quantization step size by adjusting the quantization step size for each second image unit from the generated code bit count provided from the video coding step and the bit balance of the generated bit count with respect to the average bit rate; and

in the computing step, a maximum bit rate is set, a second quantization step size is computed, which is set in the case of fixed bit rate control on the basis of the maximum bit rate, from the quantization step size set in the quantization step size setting

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step and the generated code bit count provided from the video coding step, and the greater

one of the first and second quantization step sizes is provided to the video coding step.

Claim 18 (Original): The method of variable bit rate coding video

according to claim 11, wherein:

in the quantization step size setting means for setting the reference

quantization step size for each first image unit, a first image unit complexity is computed

for each first image unit, the first image unit being defined by the product of the

summation of generated code bit rate and the average quantization step size for each first

image unit, and the quantization step size of the first image is determined from the first

image unit complexity of the first image unit and the bit rate per first image unit.

Claim 19 (Currently amended): The method of variable bit rate coding

video according to claims 11, wherein:

in the quantization step size setting means for setting the reference

quantization step size for each first image unit, the first image unit complexity is

computed for each first image unit from the summation of the generated code bit count

and the average quantization step size for each first image unit, and the quantization step

size of the first image unit is determined from the average first image unit complexity for

the first image unit over the preceding coded image, the ~~average~~ first image unit

complexity of the immediately preceding first image unit or <u>an average of</u> a plurality of

<u>the</u> first image unit <u>complexity</u> including the immediately preceding first image unit and

the bit rate per first image unit.

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Claim 20 (Previously amended): The method of variable bit rate video coding according to claims 11, wherein:

in the quantization step size adjusting means of adjusting the quantization step size for each second image unit, a threshold quantization step size is preliminarily set, when the bit balance of the generated bit count with respect to the average bit rate is not excessive, the reference quantization step size set for each first image unit is compared with the threshold quantization step size, for providing the quantization step size without any adjustment when the reference quantization step size is not exceeding the bit balance to the average bit rate, and

adjusting the quantization step size according to the bit balance of the generated bit count with respect to average bit rate and selectively providing the greater one of the adjusted quantization step size and the threshold quantization step size, and

when the bit balance of the generated bit count with respect to the average bit rate is excessive, the quantization step size is adjusted according to the bit balance to the average bit rate, the adjusted quantizing with being provided as the quantizing with for each second image unit.

Claim 21 (Cancelled).